We claim:

1. A method for transforming the state of polarization of an electromagnetic wave using a hybrid polarization transformer comprising at least one section capable of supplying a first retardation and a first angular rotation, said method comprising:

varying said first retardation; and

varying said first angular rotation.

2. The method of claim 1 wherein said varying said first retardation and said first angular rotation are performed substantially simultaneously.

3. The method of claim 1 wherein said varying said first retardation and said first angular rotation are performed alternatingly.

4. The method of claim 3 wherein said varying said first retardation is performed while said first angular rotation is substantially fixed and wherein said varying said first angular rotation is performed while said first retardation is substantially fixed.

5. The method of claim 1 wherein said varying said first retardation is performed while said first angular rotation is substantially fixed and wherein said varying said first angular rotation is performed while said first retardation is substantially fixed.

6. The method of claim 1 wherein said varying said first angle rotation comprises:

measuring a first feedback value;

dithering said first angle rotation by an angular rotation dither step;

measuring a second feedback value;

calculating a new angular rotation based on a gradient calculation; and

setting said first angular rotation to said new angular rotation.

7. The method of claim 6 wherein said calculating said new angular rotation comprises calculating a gradient using an initial angular rotation, a difference between said first and second feedback values, and said angle rotation dither step.

8. The method of claim 6 wherein said varying said first retardation comprises:

measuring a first feedback value;

dithering said first retardation by a retardation dither step;

measuring a second feedback value;

calculating new retardation value based on a gradient calculation; and

setting said first retardation to said new retardation value.

9. The method of claim 8 wherein said calculating said new retardation comprises calculating a gradient using an initial retardation value, a difference between said first and second feedback values, and said retardation dither step.

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10. The method of claim 9 wherein said calculating comprises limiting said new retardation value to a maximum retardation value.

11. The method of claim 1 wherein said varying said first retardation comprises:

measuring a first feedback value;

dithering said first retardation by a retardation dither step;

measuring a second feedback value;

calculating new retardation value based on a gradient calculation; and

setting said first retardation to said new retardation value.

12. The method of claim 11 wherein said calculating comprises limiting said new retardation value to a maximum retardation value.

13. The method of claim 1 wherein said varying said first angular rotation comprises, after measuring a first feedback value and initializing a SIGN parameter:

dithering said first angular rotation;

measuring a second feedback value;

determining impact of said dithering based on a calculated difference between said first and second feedback values;

setting said first angular rotation to a new angular rotation; and

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setting said first feedback value equal to second feedback value.

14. The method of claim 13 further comprising calculating said new angular rotation based on said calculated difference.

15. The method of claim 1 wherein said varying said first retardation comprises, after measuring a first feedback value and initializing a SIGN parameter:

dithering said first retardation;

measuring a second feedback value;

determining impact of said dithering based on a calculated difference between said first and second feedback values;

setting said first retardation to a new retardation; and

setting said first feedback value equal to said second feedback value.

16. The method of claim 15 further comprising calculating said new retardation based on said calculated difference.

17. The method of claim 1 wherein said at least one section comprises at least a first section and a second section, wherein said second section has a second retardation and a second angular rotation, wherein said varying said first retardation and said first angular rotation is performed by said first section, and wherein said method further comprises:

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varying a control parameter selected from a group consisting of said second retardation and said second angular rotation while holding the other control parameter in the group fixed.

18. The method of claim 1 wherein said at least one section comprises at least a first section and a second section, wherein said second section has a second retardation and a second angular rotation, and wherein said varying said first retardation and said first angular rotation is performed by said first section, said method further comprising:

varying said second retardation; and

varying said second angular rotation.

19. The method of claim 18 wherein said varying said first and second retardations and said first and second angular rotations are performed substantially simultaneously.

20. The method of claim 18 wherein said varying said second retardation and said second angular rotation are performed alternatingly.

21. The method of claim 18 wherein said varying said first retardation and said first angular rotation and said varying said second retardation and said second angular rotation are performed substantially simultaneously.

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22. The method of claim 18 wherein at least one of said varying said first retardation and varying said first angular rotation is performed alternatingly with at least one of said varying said second retardation and said varying said second angular rotation.

23. The method of claim 1 wherein:

said varying said first retardation comprises dithering said first retardation at a first frequency; and

said varying said first angular rotation comprises dithering said first angular rotation at a second frequency.

24. The method of claim 23 wherein said at least one section comprises at least a first section and a second section, wherein said second section has a second retardation and a second angular rotation, and wherein said varying said first retardation and said first angular rotation is performed by said first section, said method further comprising:

varying said second retardation, which comprises dithering said second retardation at a third frequency; and

varying said second angular rotation, which comprises dithering said second angular rotation at a fourth frequency.

25. A memory containing a computer program of instructions for transforming the state of polarization of an electromagnetic wave using a hybrid polarization

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transformer comprising at least one section capable of supplying a first retardation and a first angular rotation, said program comprising:

varying said first retardation; and

varying said first angular rotation.

26. The memory of claim 25 wherein said varying said first retardation and said first angular rotation are performed substantially simultaneously.

27. The memory of claim 25 wherein said varying said first retardation and said first angular rotation are performed alternatingly.

28. The memory of claim 25 wherein said varying said first retardation is performed while said first angular rotation is substantially fixed and wherein said varying said first angular rotation is performed while said first retardation is substantially fixed.

29. The memory of claim 25 wherein said varying said first angle rotation comprises:

measuring a first feedback value;

dithering said first angle rotation by an angular rotation dither step;

measuring a second feedback value;

calculating a new angular rotation based on a gradient calculation; and

setting said first angular rotation to said new angular rotation.

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30. The memory of claim 25 wherein said varying said first retardation comprises:

measuring a first feedback value;

dithering said first retardation by a retardation dither step;

measuring a second feedback value;

calculating new retardation value based on a gradient calculation; and

setting said first retardation to said new retardation value.

31. The memory of claim 25 wherein said varying said first angular rotation comprises, after measuring a first feedback value and initializing a SIGN parameter:

dithering said first angular rotation;

measuring a second feedback value;

determining impact of said dithering based on a calculated difference between said first and second feedback values;

setting said first angular rotation to a new angular rotation; and

setting said first feedback value equal to second feedback value.

32. The memory of claim 25 wherein said varying said first retardation comprises, after measuring a first feedback value and initializing a SIGN parameter:

dithering said first retardation;

measuring a second feedback value;

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determining impact of said dithering based on a calculated difference between said first and second feedback values;

setting said first retardation to a new retardation; and

setting said first feedback value equal to said second feedback value.

33. The memory of claim 25 wherein said at least one section comprises at least a first section and a second section, wherein said second section has a second retardation and a second angular rotation, and wherein said varying said first retardation and said first angular rotation is performed by said first section, said method further comprising:

varying said second retardation; and

varying said second angular rotation.

34. The memory of claim 33 wherein said varying said first and second retardations and said first and second angular rotations are performed substantially simultaneously.

35. The memory of claim 33 wherein said varying said second retardation and said second angular rotation are performed alternatingly.

36. The memory of claim 33 wherein said varying said first retardation and said first angular rotation and said varying said second retardation and said second

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angular rotation are performed substantially simultaneously.

37. The memory of claim 25 wherein:

said varying said first retardation comprises dithering said first retardation at a first frequency; and

said varying said first angular rotation comprises dithering said first angular rotation at a second frequency.

38. The memory of claim 37 wherein said at least one section comprises at least a first section and a second section, wherein said second section has a second retardation and a second angular rotation, and wherein said varying said first retardation and said first angular rotation is performed by said first section, said method further comprising:

varying said second retardation, which comprises dithering said second retardation at a third frequency; and

varying said second angular rotation, which comprises dithering said second angular rotation at a fourth frequency.

39. A hybrid polarization transformer comprising:

at least one section capable of supplying a first variable retardation and a first variable angular rotation; and

a controller programmed to vary said first variable retardation and said first variable angular rotation.

40. The transformer of claim 39 wherein said controller varies said first retardation and said first angular rotation substantially simultaneously.

41. The transformer of claim 39 wherein said controller varies said first retardation and said first angular rotation alternatingly.

42. The transformer of claim 39 wherein said controller varies said first retardation while said first angular rotation is substantially fixed and wherein said controller varies said first angular rotation while said first retardation is substantially fixed.

43. The transformer of claim 39 wherein said controller varies said first angle rotation by measuring a first feedback value, dithering said first angle rotation by an angular rotation dither step, measuring a second feedback value, calculating a new angular rotation based on a gradient calculation, and setting said first angular rotation to said new angular rotation.

44. The transformer of claim 43 wherein said controller varies said first retardation by measuring a first feedback value, dithering said first retardation by a retardation dither step, measuring a second feedback value, calculating new retardation value based on a gradient

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calculation, and setting said first retardation to said new retardation value.

45. The transformer of claim 39 wherein said controller varies said first angular rotation, after measuring a first feedback value and initializing a SIGN parameter, by dithering said first angular rotation, measuring a second feedback value, determining impact of said dithering based on a calculated difference between said first and second feedback values, setting said first angular rotation to a new angular rotation, and setting said first feedback value equal to second feedback value.

46. The transformer of claim 45 wherein said controller varies said first retardation, after measuring a first feedback value and initializing a SIGN parameter, by dithering said first retardation, measuring a second feedback value, determining impact of said dithering based on a calculated difference between said first and second feedback values, setting said first retardation to a new retardation, and setting said first feedback value equal to said second feedback value.

47. The transformer of claim 39 wherein said at least one section comprises at least a first section and a second section, wherein said second section has a second retardation and a second angular rotation, and wherein said varying said first retardation and said first angular rotation is performed by said first section, said controller is also programmed to:

vary said second retardation; and

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vary said second angular rotation.

48. The transformer of claim 39 wherein said controller is programmed to:

dither said first retardation at a first frequency; and

dither said first angular rotation at a second frequency.

49. The transformer of claim 39 wherein said at least one section comprises a plurality of sections, each of said sections having a minimum retardation and a maximum retardation, and wherein a summation of said maximum retardations at least equals to a full wave of retardation.

50. The transformer of claim 39 wherein a summation of said minimum retardations at least equals to a full wave of retardation.

51. A polarization mode dispersion compensator comprising:

a hybrid polarization transformer having an input for receiving an optical beam and an output for providing a polarization transformed beam, said transformer comprising at least one section capable of supplying a first variable retardation and a first variable angular rotation;

a PMD generator in optical alignment with said transformer;

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an optical distortion analyzer for receiving a portion of the transformed beam and providing signal that is indicative of a quality of the transformed beam; and

a transformer controller that controls the transformer based on the quality, wherein said generator is programmed to vary said first variable retardation and said first variable angular rotation.

52. The compensator of claim 51 wherein said controller varies said first retardation and said first angular rotation substantially simultaneously.

53. The compensator of claim 51 wherein said controller varies said first retardation and said first angular rotation alternatingly.

54. The compensator of claim 51 wherein said controller varies said first retardation while said first angular rotation is substantially fixed and wherein said controller varies said first angular rotation while said first retardation is substantially fixed.

55. The compensator of claim 51 wherein said controller varies said first angle rotation by measuring a first feedback value, dithering said first angle rotation by an angular rotation dither step, measuring a second feedback value, calculating a new angular rotation based on a gradient calculation, and setting said first angular rotation to said new angular rotation.

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56. The compensator of claim 55 wherein said controller varies said first retardation by measuring a first feedback value, dithering said first retardation by a retardation dither step, measuring a second feedback value, calculating new retardation value based on a gradient calculation, and setting said first retardation to said new retardation value.

57. The compensator of claim 51 wherein said controller varies said first angular rotation, after measuring a first feedback value and initializing a SIGN parameter, by dithering said first angular rotation, measuring a second feedback value, determining impact of said dithering based on a calculated difference between said first and second feedback values, setting said first angular rotation to a new angular rotation, and setting said first feedback value equal to second feedback value.

58. The compensator of claim 57 wherein said controller varies said first retardation, after measuring a first feedback value and initializing a SIGN parameter, by dithering said first retardation, measuring a second feedback value, determining impact of said dithering based on a calculated difference between said first and second feedback values, setting said first retardation to a new retardation, and setting said first feedback value equal to said second feedback value.

59. The compensator of claim 51 wherein said at least one section comprises at least a first section and a second section, wherein said second section has a second

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retardation and a second angular rotation, and wherein said varying said first retardation and said first angular rotation is performed by said first section, said controller is also programmed to:

vary said second retardation; and

vary said second angular rotation.

60. The compensator of claim 51 wherein said controller is programmed to:

dither said first retardation at a first frequency; and

dither said first angular rotation at a second frequency.

61. A dynamic optical distortion compensator comprising:

initial polarization transformer for transforming a polarization state of an optical signal;

PMD generator in optical alignment with said transformer for receiving said transformed optical signal and generating an amount of compensating distortion;

a feedback sensor for receiving at least a portion of said optical signal after being received by said generator and generating an electrical signal;

demultiplexer coupled to said sensor for receiving said electrical signal and splitting it into a plurality of separate signals; and

optical distortion analyzer and controller for receiving said separate signals and generating control signals for controlling at least said polarization transformer.

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62. The compensator of claim 61 wherein said PMD generator comprises an internal polarization transformer that is coupled to said controller.

63. The compensator of claim 61 wherein said transformer comprises at least one control section, and wherein said controller is programmed to operate said control section as a hybrid section.

64. The compensator of claim 63 wherein said controller is programmed to vary a retardation and an angular rotation of said section.

65. The compensator of claim 64 wherein said controller is programmed to vary said retardation and said angular rotation substantially simultaneously.

66. The compensator of claim 64 wherein said controller is programmed to vary said retardation and said angular rotation alternatingly.

67. The compensator of claim 64 wherein said controller is programmed to alternatingly (a) vary said retardation while said angular rotation is substantially fixed and (b) vary said angular rotation while said retardation is substantially fixed.

68. The compensator of claim 64 wherein said controller is programmed to vary said retardation and said angular rotation periodically.

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